The ratings shown in Figure 1 can be interpreted as follows:

Low: Needs additional fertilizer, no effect of salt on plant growth.

Medium: Fertilizer can be applied at the lower end but should be adequate near the top.

High: Germination and seedling growth affected as salt index increases within this range.

Very High: Apply no fertilizer, and water enough to cause salts to leach.

Additional information on lime and fertilizer requirements for nursery crops is available from local agricultural advisors. If there is reason to suspect a nutritional problem, collect matching soil and plant samples. Send them to the laboratory for analysis.

Additional information can be obtained from an NCDA&CS regional agronomist or the local Cooperative Extension office.

North Carolina Department of Agriculture & Consumer Services

Agronomic Division
4300 Reedy Creek Road
Raleigh, NC 27607-6465

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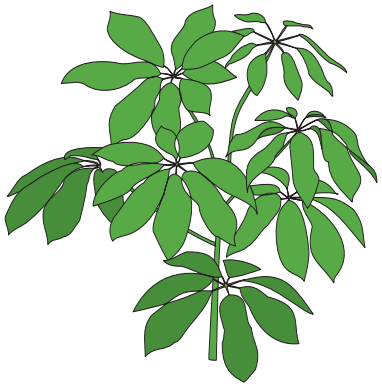
NOTE 11: Nursery Crops - - Container and Field



The goal of plant production is to grow vigorous and healthy plants in the shortest period of time. Attaining this objective depends on application of proper amounts of lime and essential nutrients. Soil testing provides a means for determining lime and fertilizer rates.

Lime Requirement

A proper soil or media pH is essential for successful plant growth. Lime neutralizes soil acidity and provides the calcium and magnesium essential for plant growth. There is no substitute for lime for neutralizing soil acidity. Lime also provides a better environment for microbial activity required for transforming nutrients to forms that plants can utilize.

There are two types of lime: calcitic and dolomitic. Calcitic lime is composed of calcium carbonate and contains little or no magnesium. Dolomitic lime is composed of a mixture of calcium and magnesium carbonates and contains a minimum of 120 lb of magnesium per ton. For maximum benefit, mix recommended lime into the soil or media prior to planting. Surface application of lime should not exceed 1.0 ton per acre (50 lb/1000 ft^2 or 50M) on established field plantings. Wait 6 months before applying additional lime.

The pH requirement for container and field-grown crops varies widely. The formula below provides a means to calculate the lime rate necessary to achieve the desired pH. Soil pH and acidity (Ac) appear on the soil test report.

[(desired pH - soil pH) / (6.6 - soil pH)] acidity = tons lime / acre

Conversion Factors

M = lb / 1000 ft^2
(tons lime / acre) 46 = lb lime / 1000 ft^2
(lb lime / 1000 ft^2) / 24 = lb lime / yd^3
(tons lime / acre) 1.92 = lb / yd^3

Micronutrients

A *$* appears in the *Recommendations* section when the index for manganese (Mn), zinc (Zn) or copper (Cu) is below 25. The *$ Note* that comes with your soil test report provides information on correcting low micronutrient levels. Most field soils contain an adequate amount of micronutrients. Pine bark mixes generally contain adequate levels of manganese and zinc but are usually low in copper.

Broad-spectrum applications of micronutrients can be unnecessary as well as harmful. Therefore, base micronutrient applications on soil test recommendations. If using a composite micronutrient source, apply the lowest rate necessary to meet plant requirements.

Container-Grown Plants

A mixture of pine bark and sand is the media used for most container-grown plants. Native pine bark, which is the major component, has a relatively low nutrient content. Successful production in this media requires supplementing with fertilizers. The challenge is to maintain adequate nutrient levels without creating a potential soluble salt problem.

The target pH for most field and container-grown plants ranges from pH 5.5 to 6.0. Nursery crops grow well in a pine bark and sand mixture at pH 5.5. The pH of native pine bark, however, ranges from 4.0 to 5.0. Application of dolomitic lime raises the pH to a more suitable level and provides the calcium and magnesium essential for plant growth. Native bark generally contains low phosphorus, calcium and magnesium with appreciable amounts of potassium, manganese and zinc.

Leaching of nitrogen, phosphorus and potassium is a common problem associated with pine bark and sand media. Nutrient leaching is most prevalent during periods of heavy rainfall or high irrigation demand. Sand that is coated with clay reduces loss of phosphorus and potassium. The clay fraction provides sites that attract and hold nutrients against leaching. Use of slow-release fertilizers also reduces leaching of nitrogen, phosphorus and potassium. The release of these nutrients depends on nutrient source, temperature, moisture and method of encapsulation. Rates of application depend on manufacturer guidelines and grower experience.

Field-Grown Plants

Lime and phosphorus do not move readily through the soil. Therefore, it is best to broadcast and mix them into the soil prior to planting. Incorporation enhances soil reaction and nutrient uptake by plants.

Nitrogen and potassium are mobile in soils. Therefore, surface applications are effective. Apply fertilizers 6 to 8 inches from plants to reduce the risk of salt injury. Split applications of nitrogen and potassium also minimize the effects of leaching on sandy soils. Nitrogen recommendations are as follows:

- First Year: Apply 50 lb N / acre prior to bud swell (approximately 0.5 oz N / plant).
- Second and Subsequent Years: Apply 80-120 lb N / acre / year. Apply two-thirds prior to bud swell and one-third in early June. Do not apply nitrogen after July 1 since late growth may be more subject to winter injury.
- Nitrogen rates may vary from rates shown above for high population plantings. Factors for converting nitrogen from lb/acre to oz/tree are as follows:

(lb N / acre) / 43.56 = lb N / 1000 ft^2
(lb N / 1000 ft^2) / ft^2 / tree = lb N / tree
(lb N / tree) 16 = oz N / tree.

Nursery Seedling Beds

Mix recommended lime, phosphorus and potassium into the soil before planting. Apply lime several weeks in advance to allow time for soil acidity to be neutralized.

Apply nitrogen after plants emerge to prevent damage from soluble salts. Use 25 to 30 lb N / acre and follow by irrigation if soil moisture is low. Use split applications for the remaining nitrogen depending on rainfall and plant growth.

On established plants, apply fertilizer in early spring before growth begins. On sandy soils, split applications of nitrogen and potassium reduce leaching losses. On sandy soils, sulfur-containing fertilizers are often beneficial.

Soluble Salts (SS-I) Interpretation

Over-application of fertilizers or inadequate watering can cause salt injury. Salt damage depends on the type of media, moisture content, temperature and plant tolerance. Ratings for different media are shown in Figure 1.

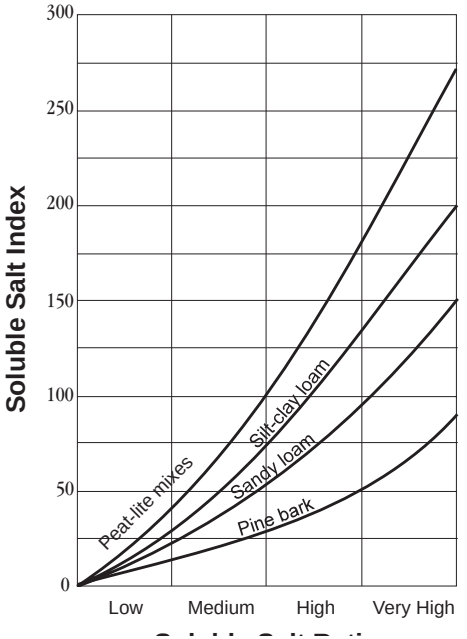


Figure 1. Soluble salt index vs. soluble salt rating.